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Beliefs and attitudes about endemic dental fluorosis among adolescents in rural Brazil

Crenças e atitudes em relação à fluorose dentária de jovens em região rural do Brasil

ABSTRACT

OBJECTIVE: To understand beliefs and attitudes about fluorosis among young people living in a rural area.

METHODOLOGICAL PROCEDURES: Qualitative study consisting of semi-structured interviews with 23 adolescents with dental fluorosis, 14 teachers and three health authorities in the city of São Francisco, Southeastern Brazil, in 2002. Content analysis and social representation theory were applied.

ANALYSIS OF RESULTS: The organoleptic characteristics of carbonates that affect groundwater (salty flavor, whitish coloration, and turbidity) associated with negative aspects of household use of this water are considered a cause of mottled enamel. Even after contact with researchers who investigated this phenomenon and helped find a solution for this condition, the local population is still unwilling to accept fluoride as the cause of the problem and does not fully agree to use water from other sources because they are afraid of the quality of water.

CONCLUSIONS: Misperceptions of the causes of dental fluorosis and water treatment costs compromise the implementation of uncontaminated surface water supplies. Health education strategies are required in parallel with solutions for securing water supply in drought-ravaged areas.

DESCRIPTORS: Adolescent. Fluorosis, Dental. Health Knowledge, Attitudes, Practice. Rural Population. Qualitative Research.

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RESUMO

OBJETIVO: Compreender crenças e atitudes em relação à fluorose dentária de jovens residentes em região rural do Brasil.

PROCEDIMENTOS METODOLÓGICOS: Estudo qualitativo em que foram realizadas entrevistas semi-estruturadas com 23 adolescentes com fluorose dentária, 14 professores e três gestores públicos no município de São Francisco, MG, em 2002. Foram empregadas a técnica de análise de conteúdo e a teoria das representações sociais.

ANÁLISE DOS RESULTADOS: Pelas características organolépticas que imprime à água (sabor salgado, coloração esbranquiçada e turbidez) e sua associação com aspectos negativos relacionados ao uso doméstico, o carbonato é considerado a causa da fluorose por adolescentes e professores. Mesmo após o contato com pesquisadores que investigaram o fenômeno e que participaram da sua solução, a população continua a resistir em aceitar o flúor como causa do problema e não concorda plenamente com o uso de água de outras fontes por duvidar de sua qualidade.

CONCLUSÕES: Percepções equivocadas em relação às causas da fluorose dentária e a dificuldade em custear o tratamento da água comprometem a implantação de suprimento de água de superfície não contaminada. Estratégias de educação em saúde devem ser implementadas paralelamente a soluções para captação de água de fontes alternativas não contaminadas em localidades afetadas pela seca.

DESCRIPTORIOS: Adolescente. Fluorose Dentária. Conhecimentos, Atitudes e Prática em Saúde. População Rural. Pesquisa Qualitativa.

INTRODUCTION

Fluoride is added to drinking water in low concentrations (0.7–1.2 mg/L in the US) to inhibit the occurrence and slow progression of dental caries.¹³ However, chronic excessive exposure to high levels of fluorine can result in dental or skeletal fluorosis. In severe dental fluorosis, the tooth enamel becomes opaque, more porous and friable with a mottled appearance ranging from white to brown and black. There is loss of enamel substance and anatomic dental deformities may occur, at times evolving toward tooth loss.⁴ In Brazil, severe forms of endemic dental fluorosis have been described in the states of São Paulo, Santa Catarina³ and Minas Gerais.^a

Many studies address the perception of this condition in non-endemic areas. In endemic areas, quantitative studies have investigated perceptions, attitudes and beliefs regarding moderate and severe forms of fluorosis (the most disfiguring forms have more significant negative psychological consequences) and its causes. However, qualitative studies are more suitable to understand how people deal with issues of water quality and scarcity and live with the disease, and can provide input on the

“denaturalization” of the causal process for more effective control strategies.^{6,9,10,12} Endemic dental fluorosis is a typical condition with a causal process that is often misunderstood by general population because fluoride dissolved in water for consumption is odorless, colorless, and tasteless. This is a complex, challenging problem to be addressed, especially because this condition manifests in an environment of water scarcity and poverty.¹

The objective of present study was to understand adolescents and young people’s beliefs and attitudes regarding dental fluorosis.

METHODOLOGICAL PROCEDURES

The city of São Francisco is located in northwest Minas Gerais, Southeastern Brazil. It has approximately 53,000 inhabitants and a Human Development Index (HDI) of 0.68. A number of wells were sunk in the 1970s by the *Departamento Nacional de Obras Contra a Seca* (DNOCS – National Department of

^a Velásquez LNM, Fantinel LM, Ferreira EF, Castilho LS, Uhlein A, Vargas AMD, et al. Fluorose dentária e anomalias de flúor na água subterrânea no município de São Francisco- Minas Gerais – Brasil. In: Silva CR, Figueiredo BR, De Capitani EM, Cunha FG. Geologia Médica no Brasil. Rio de Janeiro: Companhia de Pesquisa de Recursos Minerais; 2006. p.110-7.

Drought Mitigation) and the state irrigation company (*Águas Minerais de Minas – COPASA*) to secure water supply. This led to the occurrence of endemic dental fluorosis identified in 1995 when high fluorine content (3.2 ppm) was detected in Mocambo, a rural district of São Francisco. A survey carried out seven years later confirmed this condition, and an entire generation exposed to high fluorine levels during dental enamel formation had fluorosis. The same problem was then detected in three other districts: Alto São João, Novo Horizonte and Vaqueta with an average prevalence of Thylstrup and Fejerskov Index (TF) ≥ 4 of 65% among those aged between six and 22 years.^a

The *Instituto de Geociências* and *Faculdade de Odontologia* (Geosciences Institute and Dental School) of *Universidade Federal de Minas Gerais* (UFMG) have conducted multidisciplinary studies on fluorine exposure from water sources in the city of São Francisco and its consequences to people's health.

A qualitative study was carried out in all four rural districts of the city with three groups: adolescents and young people with visible enamel lesions of incisors; teachers who supposedly talked to their students about fluorosis-related subjects; and three public health authorities (the local health secretary, the secretary of water resources and the Mocambo community leaders). The latter were chosen due to their involvement with the detection of the problem and the development of strategies in the district of Mocambo in 1995.

The present study focused on the discourse of young people. Teachers can provide scientific knowledge as part of the formal education of their young students. And the discourse of public authorities was analyzed to better understand the timing of identification and resolution of the problem.

The students were chosen because they have developed dental fluorosis and had consequences on their teeth. Fluorosis does not cause teeth to emerge yellow or brown in the oral cavity. This coloration is caused by pigments from the oral cavity and food trapped by the hypomineralized enamel. These individuals' perception of what caused this condition and how to secure an alternative water source is of considerable interest to the multidisciplinary team that has been studying this phenomenon in the city. Likewise, it is important to understand how the teachers view this process because they directly address it in the classroom.

All interviews with 23 young students and 14 elementary and high school teachers were carried out by a single researcher. Eligible students had enamel lesions of incisors previously diagnosed during an epidemiological

survey carried out in 2002^a with TF 4 to 9.⁵ Those aged between 11 and 22 years of age (even minor lesions are commonly perceived in this age group) who were living in the affected districts were recruited following field observation.⁴ People aged 23 years and more were not included as they were not exposed to high doses of fluoride.^a A total of 66 individuals met the study criteria. These students were invited to participate in the study and their parents were asked to authorize their children's participation. Each interview lasted around 20–40 min and privacy was assured.

The saturation criterion⁷ determined the end of the interview process.

Eligible teachers were those working at the schools attended by these students. Indications were made by the principal of the teaching institutions.

Semi-structured interviews were carried among adolescents and their teachers; open interviews were carried out with local authorities aiming at reconstructing the history of the problem. All interviews were recorded on cassette tapes and transcribed by the principal researcher.

The material was submitted to content analysis: the transcribed text was systematically analyzed and categorized and the relationships between contents and with the guiding issues of the interviews were described.² The content analysis was based on contextual units, which allowed to identifying a category "causes of fluorosis". Social representation theory was applied in the discussion of the analysis categories.^{8,11}

The students, their parents, their teachers and public authorities signed a consent form to participate in the study. The study was approved by the Research Ethics Committee of the *Universidade Federal de Minas Gerais* (Protocol 060/04).

ANALYSIS OF RESULTS

Endemic scenario: poverty and water scarcity

When the wells were dug, the increased water supply encouraged people to remain in their place of origin, thereby contributing to a reduction in migratory movements and leading to political stability in the region:

"If the mayors had not sunk the wells, rural population would have all left. The wells meant redemption!" (Secretary of Water Resources)

Dental fluorosis cases began to appear a few years after the sinking of wells. The first official report of fluorosis in Mocambo came for a local community leader in

^a Velásquez LNM, Fantinel LM, Ferreira EF, Castilho LS, Uhlein A, Vargas AMD, et al. Fluorose dentária e anomalias de flúor na água subterrânea no município de São Francisco- Minas Gerais – Brasil. In: Silva CR, Figueiredo BR, De Capitani EM, Cunha FG. Geologia Médica no Brasil. Rio de Janeiro: Companhia de Pesquisa de Recursos Minerais; 2006. p.110-7.

the late 1980s who noticed something odd in younger children's teeth:

"José [community leader in Mocambo] came to me and said that children had corroded, darkened teeth. It was a new group of children, after water supply was secured." (Secretary of Water Resources)

These communities are extremely poor and do not have the necessary financial resources for water treatment and treatment of fluorosis lesions. They depend on agriculture and livestock for their livelihood and are strongly dependent on water. Water unavailability aggravates the situation, making irrigation and livestock raising activities impracticable. This makes the population resistant to the distribution of treated water by the state water company:

"This is a place of very weak, very poor people, all from large families. They are concerned they won't be able to afford the water and won't have enough money for other expenses." (Mocambo Community Leader)

As the local administration does not have the financial resources required for construction works, the Mocambo population has no other option than consume water from the Jiboia Dam and a lake that supplies water to Alto São João, both of which are unclear and with poor quality water:

"The water from the Jiboia Dam may not mottle our teeth, but it causes damage inside. It's not treated; it's dirty. There have even been animals in that water... Rats, decay... And we are forced to drink it; what else can we do?" (Student, 18 years old)

Detection of the problem and its association to the water supply

Teachers joined forces with the community and alerted the authorities:

"I worked some 15 years at the Mocambo School and I was concerned about this problem. We asked the health secretary's help so that he might take proper actions" (Teacher). This teacher would later witness incidents of discrimination involving affected and unaffected students: *"Anything led to an argument, the most effective way to hurt the other was to say, 'Go take care of your teeth! Those ugly teeth! You pig.'"*

The affected students reported that the discovery of the problem mainly came about when they compared their permanent dentition with older kids:

"Most of the younger kids had these spots; the older ones didn't." (Student, 12 years old)

The local health secretary relied on the collaboration of the *Fundação Nacional de Saúde* (FUNASA – National

Health Foundation), which was the first to examine the water for fluoride content and to conduct the epidemiological survey that detected the fluorosis endemic in 1995. A health education effort was later carried out the public authorities to alert the community to no longer use well water for drinking or food preparation:

"We made an effort to educate the population so that no one would consume well water anymore. They could use it for cleaning and clothes washing, but not for drinking." (Secretary of Health)

Causes of dental fluorosis

Those young students affected by fluorosis had a rather consistent perception of the causes of this disease regardless their district of origin. Their perceptions contrasted with those of local authorities who had frequent contact with researchers working in the area. The interviewees (except three teachers and public authorities) identified the cause by its characteristics (can feel it, taste it and see it):

"There's a problem here of fluorosis, but it's certainly also because of the calcareous rock. It propagates it in the water. When we boil the water, the rocky layer sinks to the bottom and makes that foam on top." (Young man, 22 years old)

"The students didn't come to class because they were going to fix the plumbing there. I asked them to bring in whatever was clogging the pipes. It's a kind of stone, only it's very fine. There are large calcareous stones in it. I showed it to them, 'This is what's causing the stains on your teeth.' That's what I always told them." (Teacher)

The water in all the affected districts is turbid and has a slightly salty taste, which are characteristic of groundwater rich in carbonates or "calcareous water". People think the same substance that "clogs the pipes" and is "very white" is the cause of stained teeth. The community people believe that calcareous rock causes "cancer," "kidney stones," "teeth damage," as it makes "water strong" and "corrodes the teeth," making them fragile.

Changing the water supply source did not solve the problem for the residents. In those communities that are currently supplied with water from the dam or the lake, the cause is also identified as dirt in the water, "filth," "mud that we can't see," along with the calcareous rock. The change in water supply to dam water in Mocambo and Alto São João apparently made people even more confused about their causal perception, as surface waters are not treated and become muddy during rainy periods.

No chemical treatment of the water was carried out in any of the endemic districts.

DISCUSSION

Water scarcity is a major issue in many developing countries¹³ and the city of São Francisco region face this serious problem.

Migrations due to water scarcity generally create an administrative problem in drought-affected areas as the populations become increasingly dependent on decisions and actions of public authorities to solve the issue. By handing over the power of decision regarding adequate water quality and supply to local rulers, residents seek individual solutions that are generally more costly, take more time to be implemented and are less effective than those negotiated by the community and require personal connections with public administrators. The alternative for these people would be for the community as a whole to demand adequate water quality and supply from the public administration, taking a proactive approach to ensure water supply.¹⁰

Among the districts affected by the endemic fluorosis, the discourse of authorities in Mocambo is the most remarkable. Water with a fluorine content of 3.9 mg/L is still consumed in Novo Horizonte. Alto São João has secured water supply from a nearby lake and Vaqueta has implemented a filter system but there is no maintenance.⁸ Community water supply programs throughout the world are seen as an instrument to ensure universal access to quality water. They are designed to improve people's health, make access to water easier and faster and create more opportunities of social and economic development for vulnerable groups. These goals are assumingly immediately achieved when an adequate water supply system is implemented and maintained. These projects are traditionally based on three premises: technology, institutional framework and community. However, little attention is paid to the social and cultural background of communities in these programs.¹² In fact, they do not bring immediate benefits, as clearly verified in São Francisco.

It is evident most people confound scientific information regarding causal relationship with their own perceptions. Their discourses are "contaminated" with scientific knowledge. It can be noted that they strive to assimilate and understand scientific knowledge but it is mixed up with their unpleasant day-to-day experiences. These communities are still under investigation with a very productive exchange of experiences between researchers and technicians. Thus, the representations described in the present study are characteristic of changing societies.⁸

Researchers and technicians explained local people that small doses of fluoride prevent the progression of dental

caries, but the doses found in well water are not healthy. Fluoride as a beneficial element appears as a hegemonic social representation.¹⁴ So, it maintains the dominant idea about fluoride preventing dental caries, which is propagated by scientific discourse. People believe in the benefits of fluoride (that does not have organoleptic characteristics and it is not easily identified) and "blame" the calcareous water dirt or salty water (that can be seen and tasted) and thereby resists to accept the scientific discourse that excessive fluoride was the cause of the endemic. From this standpoint, doubts and reactions to hegemonic concepts appear to be forms of social representation for resisting dominant ideologies⁸ or an escape toward non-comprehension.

In the area studied, calcareous rocks are the main source of fluoride in the water. It is therefore understandable that the students considered carbonate (or "calcareous water") as the cause of the endemic as it can be seen and tasted in the water. This association was expected because social representations allow social actors to gather knowledge and associate it to something that they can understand.¹¹ This specific behavior regarding fluorosis has previously been reported in the literature.⁹ However, most teachers had this same perception, despite having access to information from investigations on the problem. It highlights the distance between the population and the interventions by the local and academic authorities.

These findings support one of the main criticisms made to interventions in the affected districts, showing that the health education strategy is ineffective.¹²

In conclusion, the communities in the area studied have had a dramatic experience with endemic dental fluorosis that produced a strong social impact. They have difficulty to accept the new water supply and cannot afford water treatment or restorative dental treatment. These difficulties are likely to be associated to the fact that their social representations regarding the causes of fluorosis not taken into consideration prior to the technical work developed in the area during discussions for the planning of action strategies to solve the problem. They still believe that actual cause of the disease is carbonate. For changing this perception, along with strategies for securing and treating water supply, local people need to have access to scientific knowledge for the "denaturalization" of dental fluorosis. This is essential for raising people's awareness and empowering them for responsible water consumption as well as involving them in the management of water sources in their area. It may also help the implementation of other public water supply and treatment programs.

⁸ Velásquez LNM, Fantinel LM, Ferreira EF, Castilho LS, Uhlein A, Vargas AMD, et al. Fluorose dentária e anomalias de flúor na água subterrânea no município de São Francisco- Minas Gerais – Brasil. In: Silva CR, Figueiredo BR, De Capitani EM, Cunha FG. *Geologia Médica no Brasil*. Rio de Janeiro: Companhia de Pesquisa de Recursos Minerais; 2006. p.110-7.

These communities are going through a process of negotiation to ensure better water quality. This is achieved through public awareness of the importance of social

mobilization for addressing the water issue, taking into account all multiple aspects of the problem and technical possibilities for its comprehensive solution.

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